The Greatest Service to Any Country

MARGUERITE GILSTRAP

OUR MAIN crops came from all parts of the world. None of them originated in the United States. Indians, colonists, traders, immigrants, Government people, and plant hunters in turn have brought them.

Those who first imported seeds and plants sought crops that were known to be the best in the regions where they grew.

The goal has changed since then to a search for germ plasm, the substance of life by which hereditary traits are transmitted, because our widening knowledge of genetics has shown that the wild relatives of crop plants are also a rich source of improvement.

Crop breeders today use huge collections of seeds of cultivated plants and related wild species to select germ plasm for improved varieties of crops grown here and to find new crops.

The task of assembling and maintaining plant genes from the whole world has become a far-ranging, continuing, and highly productive activity of the Department of Agriculture, an activity shared by every State where plant breeders seek new frontiers.

Our crops were domesticated in many parts of the world. Corn, potatoes, and tomatoes grew in the Andes of Bolivia and Peru. Wheat, rye, and lentils along the Euphrates Basin of the Near East. Soybeans in China. Rice in southeastern India. Citrus fruit in Burma. Peas in Middle Asia, the Near East, and Ethiopia. Cherries, apples, and certain plums in the Caucasian Mountains of the Near East. Oats in northern Europe.

Their introduction to what is now the United States began with the Indians of ancient America. We do not know precisely when the crops native to Central and South America were moved northward and dispersed.

The oldest remains of cultivated corn are those found in the refuse in Bat Cave in New Mexico. They are more than 5 thousand years old. They came from plants that have disappeared from the earth, from species more akin to popcorn and pod corn than the field corns of today. The wild plants looked more like grasses. They had many short stalks, bore the ear high on the stalk, and had brittle branches, which broke easily and allowed the seeds to fall to the ground.

The great turning point in Indian culture—when seeds formerly collected for food were first saved for planting—probably occurred more than 7 thousand years ago.

Colonists from Europe found North American Indians growing corn, often with beans and squash, from the eastern seaboard to the foot of the Rocky Mountains and up the Missouri River to Montana. Some plantings covered hundreds of acres.

Columbus began the introduction of Old World crops in 1493. He carried barley, wheat, sugarcane, and grapes on his second voyage west.

The colonists who followed the Spanish armies into Florida, Mexico, and Peru took with them seeds of those and other crops they knew. They, like the immigrants through the years, settled in places that reminded them of the homes they left. Many crops brought from Spain therefore did well in the new environment.

They needed more seeds—and more. The Spanish Government consequently ordered all ships sailing for the Indies to carry plants and seeds in the cargo. Among the 147 species and varieties of introductions to New Spain cataloged from early histories are alfalfa, flax, oats, apricots, lemons, olives, oranges, peaches, pears, walnuts, cabbage, lettuce, peas, spinach, turnips, anise, fen-

nel, mustard, saffron, thyme, bamboo, carnations, daffodils, iris, and poppies.

The Indians distributed some of them. The wild peaches found by the first settlers in Pennsylvania, for instance, very likely came from Spanish plantings a century earlier in St. Augustine, Fla.

The Spaniards likewise adopted crops of the Indians—corn, white potatoes, tobacco, cotton, avocado, kidney and lima beans, cacao, the chili pepper, gourd, guava, cassava, maté, pineapple, pricklypear, pumpkin, quinoa, squash, sweetpotato, and tomato.

The first introduction from Spanish America, Orinoco tobacco, was brought by Jamestown planters from Trinidad in 1611. It became the source of colonial Virginia's most profitable crop.

Most of the food and feed crops now grown in the United States were established in colonial America by the end of the 17th century.

The ideas that were to govern the introduction of plants during the next two centuries were current then, as well—the belief that agriculture everywhere could be improved by the adoption of new methods; that the colonies could grow all the cash crops then in demand in Europe, among them rice, indigo, cotton, sugar, spices, tea, grapes for wine, and mulberry trees for silkworms; that new crops could be adapted if planting materials were brought from many different sources and grown experimentally; and that plants of all kinds should be collected for study and classification.

The colonists failed again and again in their efforts to establish the crops so urgently wanted on the European market. Few of the plants introduced repeatedly from the subtropics survived the winters of even the southernmost Colonies.

But finally, in the 1690's, South Carolina planters found—in seeds from Madagascar—the hardy productive rice that could be grown on their lowlands. And in 1745, Eliza Lucas, then only 18, introduced the indigo seeds that gained a foothold for this highly prized crop. They came from Antigua, West Indies, where her father was governor and she had formerly lived.

To tobacco, rice, and indigo, planters of the Southern Coastal Plains added a fourth profitable crop shortly after the American Revolution.

This was sea-island cotton, the seeds of which were introduced from the Bahamas. Its advantage over upland cotton, which had been introduced by the Indians, was that the lint separated easily from the seeds. The cotton gin, patented by Eli Whitney in 1793, however, overcame this difficulty for upland cotton and soon paved the way for the expansion of the crop.

Plant introduction during the 18th century reflected the keen interest in experimentation then beginning to rise in the Western World.

An example is the colonists who left England for Georgia in 1735. Even before they left, they set aside 10 acres for an experimental garden. They hired a competent botanist to explore for "usefull Plants . . . found wanting in America." Neither the botanist first engaged nor the one who was hired to succeed him introduced any seeds or plants—they did not even reach Georgia. But the men in charge of the Trustees' Garden in Savannah proved to their own satisfaction that the climate was too severe for the subtropical plants under study. They turned the plot into a nursery for grapevines and mulberry trees. Fifteen years after the garden was laid out, they decided to abandon the enterprise, but it had served a purpose.

Many of the fruits and ornamentals imported during the 18th century were first grown in the gardens of able plantsmen such as George Robbins of Easton, Md., Henry Laurens and Charles Drayton of Charleston, S.C., and John Bartram of Philadelphia.

Bartram, a farmer who taught himself botany, was considered by the great Swedish botanist Carolus Linnaeus to be "the greatest natural botanist in the world." His botanical gar-

den near Philadelphia, the best known in colonial America, specialized in the plants of this continent. It was also the point of introduction for many different kinds of seeds sent to him by Benjamin Franklin and other Americans traveling abroad and by the directors of the botanical gardens in Europe.

Franklin and Thomas Jefferson were among the leading citizens of colonial America whose interest in plant introduction was no less practical than it was scientific.

On missions abroad they carried on a brisk exchange of seeds with growers at home. Franklin introduced two Scottish crops to America—rhubarb and kale.

Jefferson risked the death penalty in northern Italy to obtain seeds of an upland rice for South Carolina. The provincial government, seeking to protect its monopoly, prohibited the export of seed. Jefferson smuggled them out in his coat.

Franklin and Jefferson, like other influential men of their times, had studied the work of Linnaeus and other botanical authorities. They were well acquainted with the directors of botanical gardens of Europe and exchanged seeds and other plant material with them. Before members of agricultural and scientific societies then being organized on both sides of the Atlantic, they discussed their observations of plantlife.

With the founding of the Republic, the societies became powerful forces in plant introduction. Their members were wealthy men who could afford to try new methods and make mistakes. They believed the success of agriculture depended on the diversification of crops and the cultivation of new and unusual ones.

A fluent spokesman for these ideas was Elkanah Watson, one of the founders of the New York Society for the Promotion of Useful Arts and the Berkshire Agricultural Society in Massachusetts.

Watson in 1817 sent a circular letter requesting seeds from the consuls in Europe. An enthusiastic response came from Valencia, Spain. There, at Watson's suggestion, the consul turned to an eminent Spanish botanist for help in selecting varieties of grain that should do well in this country. The seeds of 14 kinds of wheat, one of oats, and one of barley were sealed in a cask and sent to Watson.

Farmers in a Shaker community near Albany, N.Y., were among those who grew the wheat and reported with favor on one variety. The results so impressed James Madison, then president of the Virginia Agricultural Society, that he mentioned them in an address to the society. The address was published in the American Farmer, a new and influential journal.

Government officials perceived the importance of Watson's work.

William H. Crawford, Secretary of the Treasury, in 1819 issued a circular to consuls and naval officers asking them to send useful plants and seeds to collectors at American ports. The Congress appropriated no funds for the work, but the Agricultural Society of South Carolina allotted 200 dollars a year, beginning in 1823, to pay naval officers for the costs of correspondence.

President Monroe meanwhile had selected a skilled botanist to go as ship's surgeon with an American Commission to South America. Dr. William Baldwin collected seeds and plant specimens near Rio de Janeiro, Montevideo, and Buenos Aires and met the leading botanists of the countries he visited.

A member of the Commission, Theodorick Bland, introduced a wheat that gained wide attention. The variety, which came from Chile, was distributed by the American Farmer and grown for a time in Maryland and Pennsylvania.

CROP SEEDS were indispensable to 9 out of 10 households in the early days of the Nation. Most of the seed was homegrown. Seeds for new land were obtained by purchase or trade from other farmers.

The first seedhouse—David Landreth & Son of Philadelphia—was opened in the 1780's. The seed industry grew slowly. Forty-five seed firms, most of them in the East, flourished in 1850.

Growers in New York and Pennsylvania were supplying timothy and clover seeds for export in the early 1800's. Later the center of production moved into the Ohio Valley, and Toledo for a time was the largest market of grass seed in the world.

Seeds for many of the vegetables grown in this country before the Civil War were brought by the wives of immigrants, who then saved seed from each year's harvest.

The early colonists brought fruit trees with them, but most of the trees were grown from seed during the days of the westward migration.

John Chapman earned the name of "Johnny Appleseed" by washing seeds out of the pomace at cider mills and planting orchards as he strode through the wilderness. He was not alone. The first orchards in almost every State began in that way.

Farmers liked to get free seeds from whatever source. At the time Elkanah Watson distributed seeds from Spain, farmers in the Middle Atlantic States desperately were seeking varieties with resistance to hessian fly, a pest first observed in the 1760's. The susceptibility of varieties most used in Pennsylvania and New York helped the fly spread wherever wheat was grown.

Watson's introduction had habits of growth that made it appear resistant for a time, but it was not the answer.

The late-seeding wheat that helped eastern growers gain some control over the pest was sent to a New York farmer by a friend on Navy duty in the Mediterranean. Andrew J. Beaumont, a Pennsylvania farmer who obtained some of the seeds, advertised the wheat in the Pennsylvanian late in the 1830's and received orders from all parts of the country.

Dr. Henry Perrine, consul at Campeche, Mexico, strongly advocated the introduction of new crops and avidly collected fiber-producing agaves and other subtropical plants. After 10 years in Mexico, he persuaded the Congress to grant him and his associates a township of more than 30 thousand acres on Indian Key, near what is now Miami.

He imported more than 200 varieties of tropical plants and made sisal plantings on every section of the grant before he was killed in an Indian massacre on Christmas morning of 1838.

The Perrine grant was the last one the Congress made in attempts to introduce new crops. Two previous ones in Ohio and Alabama had failed.

Henry L. Ellsworth, Commissioner of Patents, had wide support in 1838 when he asked the Congress to appropriate money for collecting and distributing seeds. Agricultural societies, which were dedicated to the introduction of superior varieties and completely new crops, helped Ellsworth distribute the seeds and plants sent by consuls and naval officers. Congressmen distributed some of the seeds.

Ellsworth wrote: "Inventors are sanguine in the belief (and probably not without reason) that the time is not far distant when ploughing machines will be driven by steam, and steampower applied to many other operations of the husbandryman. . . . A subject intimately connected with this is the aid which husbandry might derive from the establishment of a regular system for the selection and distribution of seeds of the choicest varieties for agricultural purposes."

The Congress responded in 1839 by appropriating 1 thousand dollars of fees collected by the Patent Office to support his work in agriculture. Part of the money was allotted to the collection of information on agriculture in the 1840 census. The remainder was for collecting and distributing seed.

Thus began the distribution of free seeds, an activity that continued until 1923 and supplied Americans, through their Congressmen, with billions of packages of seeds. Most of them were

seeds of vegetables and flowers, but also included were seeds of sorghums, sugarbeets, soybeans, and many others.

The demand for seeds rose sharply in the 1840's as pioneer families moved across the continent into new territories and as more and more immigrants arrived.

By the end of the decade, the Patent Office was distributing more than 80 thousand packages of seeds each year. Some of them were gifts of European governments.

Complaints of poor germination led to questions as to the reliability of the sources of supply. Some questioned the wisdom of those who had selected sugar and tea as the most urgently desired new crops.

Sugar was the costliest food item. Louisiana canes, the only domestic supply, were dying out. The Patent Office in 1856 sent Townend Glover, an English entomologist, to the northern coast of South America to assemble a cargo of cuttings. The *Release*, a Navy vessel, was assigned to bring the cargo to New Orleans. The canes, selected and packed by the best means then known, were infested with borers when the ship reached port. Even so, the cargo was unloaded, and growers were urged to take whatever planting material they could use. The high risks of introducing crop pests were not fully recognized for more than 50 years.

Chinese Amber sorgo, which had just been introduced into Europe, was among seeds of many kinds purchased by D. J. Browne in 1854 on the first official trip abroad to buy seeds for free distribution. He also arranged with reliable firms in Paris, Hamburg, Liverpool, and London to supply the Government with seeds.

Even his political enemies agreed that the new sorgo should be widely known and grown. Orange Judd, editor of the influential American Agriculturist, wrote about it, and gave away 36 thousand pounds of free seeds.

A 5-acre plot was set aside in Washington for the increase of the sorgo seeds. It was the first Federal plant propagating garden. It was the forerunner of experimental plots that now cover thousands of acres for cooperative use by the Department and State agricultural experiment stations.

So great was the interest in sirup-producing crops that South Carolina hired an English planter to introduce superior selections from Africa. Along with Chinese Amber, the 16 sorgos Leonard Wray brought to the United States in 1857 were planted on thousands of acres. The sorgos never lived up to expectations as a sugar-producing crop, however, and were discarded for that purpose when sugarbeets became established.

Hardy alfalfas arrived in the United States in the decade before the Civil War. The valued forage had been introduced time and again and grown during colonial days under the name of "lucerne." The variety that took hold in the eastern half of the country carries the name of Wendelin Grimm, a German immigrant who carried the seeds to Minnesota.

The Forty-niners introduced a Chilean alfalfa. They got seeds of it when they were on their way to California by way of Cape Horn. The Patent Office got seeds of it for free distribution from a dealer in San Francisco.

The Rev. Chauncy Goodrich, of Utica, N.Y., reported in the Cultivator in 1850 that he hoped to "renovate" the potato by using true seed of importations from South America. He wanted a variety with resistance to the blight that led to the Irish famine. He did not achieve that goal, but he laid the foundation for potato breeding in this country by selecting highly desirable germ plasm. His selection of Garnet Chili, a seedling of the imported Rough Purple Chili, was widely grown and used in parent stock of 170 varieties, including Green Mountain, Burbank, Early Ohio, and Early Rose.

MORE AND MORE of the supplies of the free seed distribution program came from domestic sources. For example, American seedsmen in 1912

supplied nearly all of the vegetable seeds in the 63 million packets distributed by the Department. Most of the flower seeds, however, came from Germany, France, and North Africa.

The outbreak of the First World War stopped the flow of seeds from Europe to the United States. It created new markets for the American seed industry. At home, victory gardens met wartime demands for food. In Europe, seeds from the United States replaced supplies disrupted by the war. After the Armistice, the demand for American seeds on the home market continued. Seedsmen expanded plantings, chiefly in the West, to serve the rapidly growing canning industry.

The end of the distribution of free seeds in 1923 raised an important question. How should the Department release superior new varieties of crop breeding research? The answer was found in cooperative agreements with the State agricultural experiment stations and the seed industry. An elaborate machinery has been set up to provide the seed industry with small amounts of seeds of new varieties. From these, the industry builds up commercial supplies.

THREE MEASURES enacted by the Congress in 1862 stimulated Federal plant introduction in strikingly different ways.

The Homestead Act, which gave land to those who would settle it, attracted thousands of people to the West immediately after the Civil War. Soon they were asking the Government for seeds of crops suited to the drylands, the river valleys, and the western plains.

The act of 1862, which established the U.S. Department of Agriculture, directed the new agency to "collect new and valuable seeds and plants; to test, by cultivation, the value of such of them as may require tests; to propagate such as may be worthy of propagations; and to distribute them among agriculturists."

The Federal Land-Grant Act of 1862 supplied the States with funds for colleges where young people could be trained in arts and sciences relating to agriculture. It was possible to build up in the colleges scientific staffs for collecting, testing, propagating, and distributing crop seeds. Fifteen years later, the Hatch Act gave further impetus to agricultural research by adding Federal support for State agricultural experiment stations.

Three important crops introduced in the 1860's were durum wheats, sugarbeets, and the navel orange.

The wheat we got from the Russian Ukraine made available on the Northern Plains varieties that were suited to a cold, dry climate and supplied the emerging milling industry with flours for macaroni and other pastas.

Seeds of sugarbeet from France and Germany took hold in Illinois and gave the Midwest the long-sought productive sugar crop.

In the navel orange from Brazil, California had a crop that soon had a value of millions of dollars. Many previous attempts to introduce this superior orange failed. William Saunders, a botanist and superintendent of the Department's propagating gardens, turned his exceptional skills to the task, gave directions for packing the buds for shipment from Bahia, made the grafts, and produced the vigorous young trees that were shipped to California.

James Wilson, who became Secretary of Agriculture in 1897, was the first man in the office who was thoroughly familiar with crop needs in the Western States and the possibilities of crop improvement through research. A farmer himself, he had gained recognition as an agricultural leader through his work in the Iowa Legislature, his widely published writings, and his service as director of the Iowa Agricultural Experiment Station.

Shortly after Secretary Wilson entered the Cabinet, he sent Prof. Niels E. Hansen of South Dakota State College to Russia to collect cold-resistant fruits and cereals for the Great Plains.

Hansen, a Dane who grew up in Iowa, first visited Russia during vacation while he was a graduate assistant in horticulture at Iowa State College. When he went again as a plant explorer in 1897, he traveled 2 thousand miles by wagon and sleigh from the southern part of Turkestan to western China. The five carloads of seeds and plants he shipped to the United States on that first trip included seeds of several hundred different grains and forages. Among them was seed of a hay crop he found on the steppes of Siberia that survived the severest drought and subzero weather. It was the seed of crested wheatgrass.

As Hansen's vast collections began to arrive in Washington, David Fairchild and Walter T. Swingle, young scientists of the Department, suggested a way to finance further explorations. They would set aside a portion of the funds for distribution of free seed to introduce carefully selected crops.

Secretary Wilson liked the idea, presented it to the Congress, and gained approval. The appropriation act of 1898 specified that 20 thousand dollars of the appropriation of 150 thousand dollars for free seed be used for the introduction of seeds. Secretary Wilson established a Section of Seed and Plant Introduction. Fairchild headed it.

The first assignments of the newly formed section went to Mark Carleton and Seaman A. Knapp, men well qualified to be agricultural explorers.

Carleton, a cereals specialist, grew up on a Kansas farm and knew firsthand the hardships of wheatgrowers who lost their crops to bad weather and disease. He proved in research at the Kansas Agricultural Experiment Station that rusts are specific for each kind of grain. Then he joined the Department of Agriculture and demonstrated, through research on more than a thousand varieties of wheat, that only a few of them could stand up to the worst conditions under which wheat was grown here.

His search for hardy, rust-resistant wheats in Russia took him across the Urals to western Asia. His great contributions were the introduction of Kabunka and Khrakov wheats, which could "stand the worst years."

Dr. Knapp went to the Orient to look for rice varieties for the Coastal Plains of Louisiana and Texas. Then 65, he was an influential spokesman for scientific agriculture. He was the driving force in building a rice industry in Louisiana in the 1890's. Seeking markets for farmers associated with him in a great land-development program in the western part of the State, he established the first rice mill west of the Mississippi, helped organize the Rice Association of America, and founded and edited the Rice Journal and Gulf Coast Farmer.

Dr. Knapp's interest and experience in agriculture were far broader than the rice crop. He was a strong advocate of diversified farming. A former professor and then president of Iowa State College, he had drafted the proposal for Federal aid to agricultural research on which the Hatch Act was based. After his agricultural explorations, he carried on farm demonstration work in the South that led to the passage of the Smith-Lever Act in 1914 and the establishment of the Federal Extension Service.

From his first trip to Japan in 1898, Dr. Knapp introduced Kiushu rice, which yielded a fourth more than the varieties formerly grown in Louisiana. Two years later he obtained seeds of other varieties of rice and other crops on a trip by train and mule that covered much of Japan, China, Siam, Burma, Ceylon, the Philippines, and Hawaii.

Plants sent home by Hansen, Carleton, and Knapp had become well established by 1920. Hansen's important finds—crested wheatgrass and bromegrass—supplied farmers of the Northern Plains with forage for livestock. Carleton's hard red winter wheats had begun to transform the Great Plains into a breadbasket of the world. The short-grained rice varieties Knapp brought from Japan assured

the mid-South and California a vigorous new industry

Fairchild, Swingle, and other agricultural explorers combed the world for crop plants of all kinds that might be grown in the United States and for ornamentals to add beauty wherever they could be grown.

The prized Chinese elm of farmsteads and towns across the Plains and the zoysia grasses that carpet many lawns were introduced by Frank N. Meyer, a young Dutchman, who between 1905 and 1918 walked thousands of miles in Asia as a plant explorer for the Department.

IT WAS NOT enough to find plants, identify them, and ship them home.

Plant introduction gardens were set up in Chico, Calif., Glenn Dale, Md., and Coral Gables, Fla., to receive the new material, grow it under constant inspection, and make the first tests for adaptation.

O. F. Cook organized an ingenious, highly necessary system of keeping records of the vast flow of material from our agricultural explorers, private firms and public agencies of other countries, and American officials on duty abroad.

Ever since 1898 each plant immigrant has been listed by number and identified by name. More than 265 thousand items were listed in the inventory of plant introductions by 1961.

At first the explorers sought plant immigrants that could make themselves immediately at home in the United States and could be grown commercially. Among those widely planted as fast as the growers could get seeds of them were alfalfas from Peru, Arabia, and Turkestan and Siberia; wheats from Australia and Russia; date palms and the insects to pollinate them from Turkey; and grapes from Italy and Greece.

Scientists learned to identify the genes responsible for certain plant traits, draw up specifications for genes desired in a new variety, locate those genes in breeding stocks, and recombine them in improved varieties.

They learned very soon that this genetic approach would require large reservoirs of plant germ plasm.

W. G. Wight, a Department explorer who collected 250 sorts of cultivated and wild potatoes at various places in the Andes in 1913, initiated a practice that was to become routine for every crop—the search for plant genes in centers of high variability, often near the place of origin of the crop. A striking example of the benefits of seed and plant exploration is the soybean crop.

The soybean was one of the slowest crops to become established in North America. In 1907, more than a century after the first recorded introduction, fewer than 50 thousand acres were in soybeans in the United States.

Scientists learned that a crucial difficulty was the unusual sensitivity of the soybean to the day-night cycle. Day-length controls its flowering and maturing. A soybean planted very far north of its zone of adaptation matures so late it is damaged by frost. Planted south of its adapted zone, the soybean yields poorly.

The selections that took hold in the United States were chosen from more than a thousand introductions between 1900 and 1912 under test in the Department of Agriculture. Twenty of these immigrants were included in the free seed distribution after 1914.

Soybeans were grown on more than 2 million acres in 1927, when the Department sent W. J. Morse and P. H. Dorsett to Asia to make an exhaustive search for additional soybean breeding material. During the next 2 years they assembled seeds of more than 3 thousand selections to give the United States a bank of soybean germ plasm unmatched in the world.

Soybean breeders in Federal-State cooperative work make continuing appraisal of the germ plasm collection. It supplied the genes for 22 improved varieties released for field crops between 1936 and 1960. These include specific varieties for each zone where

soybeans are grown commercially, a total area in the United States of more than 26 million acres. The improved varieties produce 10 to 20 percent more beans, have a higher content of oil, stand more erect in the field, and can be harvested by machine more easily than the plants they replaced.

The bank of germ plasm has become a weapon against crop pests. When soybean cyst nematodes were observed for the first time in the United States in 1954, none of the commercial varieties carried resistance to the disease. When the 4 thousand selections in the germ plasm bank were evaluated, three sources of resistance were found.

The reservoir of germ plasm so carefully built and carefully watched over by soybean breeders has its counterpart in world collections of breeding material of all the main—and some lesser—crops of the United States.

As the store of germ plasm has grown and the demands for it have multiplied, our national policy for handling it has been revised. The Congress broadened the base in 1946 in certain provisions of the Agricultural Research and Marketing Act. These provide funds for the support of introduction centers in the regions where the plant is most widely grown or most likely to be adapted. The act also gives Federal support to research on introduced material at State agricultural experiment stations.

The Department has responsibility for the exploration for seeds and plants and their introduction, inspection, and quarantine. Much of the material goes directly to the primary introduction center where it is to prove its value to agriculture.

Peanuts, sesame, castorbeans, and subtropical grasses go to the regional center at Experiment, Ga.

Corn, alfalfa, soybeans, and other crops suited to the Midwest are sent to the center at Ames, Iowa.

Beans, peas, safflower, and similar western crops go to the center at Pullman, Wash.

In the Northeast, forage introductions go to Geneva, N.Y.; and fruit and other crops of regional interest are sent to the Plant Introduction Garden at Glenn Dale, Md.

All potato introductions are sent to the interregional potato introduction station at Sturgeon Bay, Wis.

The regional introduction stations propagate the seeds, make a preliminary check for growth and disease characters, retain some of the seeds on file, and distribute the remainder to experiment stations for evaluation.

MANY VALUED sources of plant germ plasm have been lost.

Many of them were discarded because they did not serve the immediate interest of a crop breeder. They were susceptible to insects or disease or unsuited to machine production. They gave poor yields in the field.

Many seeds of once prized commercial varieties also have disappeared as those varieties became obsolete.

It is estimated that 75 percent of the alfalfa breeding material and more than 90 percent of the different kinds of clovers introduced over a period of 40 years have been lost. The full measure of the loss cannot be taken. Most of the seeds had been studied for only one or two characters. Their potential can only be guessed, but the estimates rise as crop breeders improve their skills in screening germ plasm and recombining the genes in improved varieties.

To safeguard the treasures in plant germ plasm already assembled and those to be added through the years, our Government has built a national repository—the National Seed Storage Laboratory—in Fort Collins, Colo. The first seeds were accepted for storage in 1958, just 60 years after the Department of Agriculture began an organized search for new crops.

The stocks come from crop breeders in the Federal-State agricultural network, the universities, commercial seed companies, private individuals, and interested groups. For instance, the American Seed Trade Association has

taken the responsibility for assembling seeds of vegetables that once were sold commercially but are now obsolete. Along with the sample, each donor provides a record to show why the seeds are considered of value.

All seeds become the property of the Federal Government. To be accepted, they must pass a test for viability. They are then placed in containers and stored in rooms where humidity and temperature can be held at the best levels to maintain viability. In nine of the storage rooms, the temperatures are held at 20° to 40° F.; in the tenth, between 0° and 30°.

Research in the National Seed Storage Laboratory is devoted to physiological problems in viability of seeds as it relates to longevity. The laboratory rejuvenates the stocks of seeds in storage and publishes periodical inventories of the collection. It also supplies, without charge, material not readily obtained from other stores of plant germ plasm to any bona fide research worker in the United States.

It is not designed to service requests from other countries. These are handled by the New Crops Research Branch of the Agricultural Research Service, and the material may be supplied from various centers.

The laboratory is a symbol of the growing public awareness of the great value of the plant germ plasm brought together from all parts of the world. The genes can serve, like money in the bank, for meeting new and continuing threats of crop pests and as capital for new ventures to open wider markets.

As Jefferson pointed out when the Nation was young, "The greatest service which can be rendered to any country is to add a useful plant to its culture."

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Age-Old Uses of Seeds and Some New Ones

FREDERIC R. SENTI AND W. DAYTON MACLAY

THE FOOD stored in seeds for their early growth also is food for people and animals.

Wheat is the world's bread grain. Rice is used almost entirely as food and is the main crop of southern Asia. Sorghum and millet are staples in parts of China and Africa. Corn is popular in South Africa and Latin America. Barley, rye, and oats also contribute to the world's food supply.

Nine-tenths of all seeds cultivated are cereal grains—the breadstuffs of the world. By far the greater part of the food of all the people in the world consists of seeds.

Civilization developed in Egypt and Mesopotamia because of their favorable climate for cereal grains. The civilizations in ancient America were the product of those Indian races who knew best how to grow corn. Ceres was the Roman goddess of growing vegetation and her name we associate with grain—cereals.

Legume seeds are the second great group of seeds we use for food. All kinds of beans, peas, and lentils supply protein. Dry, they contain 25 to 40 percent protein, and some are rich in carbohydrates.

Some legumes, such as soybeans and peanuts, are high in oil and protein, as are certain other seeds, particularly rape, sesame, and sunflower. Soybeans are 20 percent oil. Peanuts are 50 percent. Seed oils furnished about 55 percent of the world's edible oils and fats in 1959. (Nearly half the edible oils came from soybeans and peanuts.) Animal fats provided about 42 per-